Regulations to add low-emission field fumigation methods and remove language that now occurs on federal labels
(DPR Regulation No. 15-002)

Attachment 5

Alternatives Analysis

California Environmental Protection Agency
Department of Pesticide Regulation

Reducing Volatile Organic Compound Emissions from Pesticides: Analysis of Alternatives for Low-Emission Field Fumigation Methods

Summary

California's ozone state implementation plan (SIP) for the federal Clean Air Act has an element that requires the Department of Pesticide Regulation (DPR) to:

(1) Develop and maintain an inventory to track volatile organic compound (VOC) emissions from pesticides, and

(2) Reduce pesticide VOC emissions by specified amounts in five ozone nonattainment areas (NAAs).

To meet its SIP requirements, DPR put regulations into place from January 2008 to the present to reduce emissions from VOCs due to agricultural use.

Two ozone NAAs (Sacramento Metro and South Coast) have met their pesticide SIP goals for many years and no further reduction measures are needed, although they still must fulfill reporting and other requirements. For the other three ozone NAAs (San Joaquin Valley, Southeast Desert and Ventura), DPR considered seven different measures for reducing pesticide VOC emissions, and selected three for implementation:

- Use alternative application methods,
- Reduce fumigant usage, and
- Reformulate certain pesticide products.

Other measures that would reduce pesticide VOC emissions are infeasible and not needed at this time to achieve the SIP goals.

For two ozone NAAs (Southeast Desert and Ventura), DPR adopted a series of regulations for fumigants beginning in 2008 that require low-emission fumigation methods. The regulations also set up a fumigant emission limit that is triggered if low-emission fumigation methods do not result in targeted reductions. The fumigant emission limit was in effect for the Ventura ozone NAA during 2009 – 2014, but fumigant emissions have decreased and have stayed below levels that would trigger a fumigant emission limit.

Between September 2008 and April 2011, DPR amended these regulations, primarily for fumigants, to:

- Phase in pesticide VOC reductions between 2008 and 2012 in the Ventura ozone NAA area;
- Revise the total pesticide (fumigant and nonfumigant) VOC emissions benchmarks in all ozone NAAs that are used to reduce pesticide fumigant emissions, and delay fumigant limits and allowances in all ozone NAAs except Ventura until 2011; and
- Revise existing field fumigation methods; amend triggers for fumigant limits in ozone NAAs and the allowance system used to enforce the fumigant limits; and clean up sections in the regulations pertaining to licensing and pesticide use reporting.

The low-emission fumigation methods required in the 2008 regulations also apply to the San Joaquin Valley ozone NAA. However, nonfumigant pesticide products contribute more VOC emissions than fumigants in this NAA. Therefore, DPR adopted nonfumigant regulations that designate certain products containing abamectin, chlorpyrifos, gibberellins, and oxyfluorfen as high-VOC products. Among other actions, San Joaquin Valley growers must obtain a recommendation from a pest control adviser prior to certain uses of these high-VOC products, and pest control advisers are required to recommend low-VOC products when feasible.

Recent studies have shown that a new technology, the totally impermeable film (TIF) tarpaulin, significantly reduces emissions from field fumigations. DPR determined that using the TIF tarpaulin methods would reduce the emissions enough to meet the "low-emission" criteria. Therefore, using its regulatory authority DPR granted temporary, interim status in 2013 and 2014 to some of the existing methods (that use polyethylene tarpaulins) if they instead use TIF tarpaulins. In April 2016, DPR amended regulations to change the status of these low-emission field fumigation methods from interim to permanent in all five ozone NAAs and made changes to be consistent with federal product labeling. These fumigation methods are the same as existing ones; however, they use TIF tarpaulins that quality for U.S. Environmental Protection Agency (EPA) 60% buffer zone reduction credits. This regulatory action pertains to some of the most widely used fumigant active ingredients in agriculture in the state: methyl bromide, 1, 3-dichloropropene (1, 3-D), chloropicrin, metam-sodium, and potassium N-methyldithiocarabamate (metam-potassium).

Allowing the continued use of this technology (i.e., TIF tarpaulins) enhances the SIP and aids DPR in its efforts to reduce VOC emissions.

Introduction

The purpose of this paper is to present and analyze (1) various alternatives to interim practices recently adopted into regulation, and (2) uses of low-emission field fumigation methods to reduce VOC emissions. DPR documents (DPR 2014d and 2015) contain background information listed below; therefore, we will not include it in this document.

- Summary of DPR's general authority to regulate the sale and use of pesticides, and of previously adopted regulations;
- Description of DPR's pesticide VOC emissions inventory;
- Background information on fumigants;
- Description and evaluation of field fumigation method options;
- Other reduction options for pesticide VOC emissions; and
- Current research on fumigant VOC emissions reduction.

To assist U.S. EPA with its review of these regulations, this document contains information on DPR's evaluation of these new and revised low-emission field fumigation methods. The following web page contains the low-emission field fumigation methods and supporting documents: http://www.cdpr.ca.gov/docs/legbills/rulepkgs/15-002/15-002.htm.

Background

DPR regulations control VOC emissions from fumigants during the May through October peak ozone season in the five ozone NAAs. These regulations include provisions that only allow the use of fumigation methods for which DPR has adequate data to determine VOC emission rates. In addition, the regulations include a provision that enables DPR's Director to grant interim approval of fumigation methods with emissions no greater than the field fumigation methods allowed in the regulations in the respective ozone NAAs. Once the Director grants interim approval to a method(s), the method(s) may be used for three years from the effective date before it expires.

In 2012, U.S. EPA approved updated labels for soil fumigants currently registered to include new requirements for buffer zones and related measures. The revised labels include buffer zone credits for tarpaulins that greatly reduce the emissions of fumigants in the soil, known as TIF tarpaulins. The federal label refers to them as tarpaulins that have been tested for permeability and determined by U.S. EPA to qualify for at least 60 percent buffer zone reduction credit.

Within the five ozone NAAs during May 1 through October 31, only the fumigation methods specified in Title 3 California Code of Regulations (CCR) sections 6447.3, 6448.1, 6449.1, and 6450.1 are allowed; however, some of these methods classified as "high emission" are prohibited in the San Joaquin Valley (SJV), Southeast (SE) Desert, and Ventura ozone NAAs.

As mentioned above, DPR's Director may grant interim approval of fumigation methods that reduce VOC emissions. The interim method must be accompanied by scientific documentation showing VOC emissions are not higher than other "low-emission" methods allowed in ozone NAAs. The interim approval expires three years after the date of the approval unless adopted in regulation. Title 3 CCR section 6452 establishes two different standards, listed below, by which to evaluate whether a new fumigation method will be allowed.

(1) The Sacramento Metro and South Coast ozone NAAs have a less stringent standard because no further VOC reductions for pesticides are needed in these NAAs. Growers in these two ozone NAAs may use either "low-emission" or "high-emission" fumigation methods any time of the year.
(2) In the SJV, SE Desert, and Ventura ozone NAAs, growers may use only "low-emission" methods and only during the May through October peak ozone season.

The key information is the emission rating (percent of the fumigant applied that is emitted to the air) and emission rate (emission rating multiplied by the application rate). The emission rating or the emission rate must be equal to or less than that of the current methods allowed by regulation in the ozone NAAs. The maximum emission rating allowed in the SJV, SE Desert, and Ventura ozone NAAs for 1, 3-D and chloropicrin is 44 percent; it is 48 percent for methyl bromide. Table 1 shows the emission criteria for approving new fumigation methods in all the ozone NAAs.

TIF Tarpaulins and More—Additional Low-Emission Field Fumigation Methods

Numerous researchers have been working on methods to further reduce fumigant emissions. The U.S. Department of Agriculture sponsored much of this work as part of two area-wide programs on methyl bromide alternatives. The Pacific Area-Wide program included several multi-year projects in California to develop, demonstrate, and implement fumigant reduction measures. This research led to additional low-emission fumigation methods. In April 2013, DPR issued interim approval for several fumigation methods that use low permeability (i.e., TIF) tarpaulins developed in part by this program, as well as several other methods (Table 2). Field monitoring data indicated that low permeability tarpaulins reduce emissions of some fumigants by 70 to 80 percent.

In deciding whether a new method meets the standard for interim approval, DPR must assess the scientific data submitted to establish the emission rating, normally consisting of field monitoring data. In evaluating this data, 3 CCR section 6452 requires DPR to consider whether the:

- Information is sufficient to estimate emissions,
- Results are valid as indicated by the quality control data, and
- Conditions studied represent agricultural fields.

Over the last several years, DPR has reviewed several studies that estimate fumigant emissions from applications that use TIF tarpaulins. Except for the type of tarpaulin, fumigations with TIF tarpaulins are identical to other methods specified by DPR's VOC regulations. DPR defined TIF tarpaulins as those for which federal labeling assigns a buffer zone reduction credit of 60 percent. DPR determined that the TIF tarpaulin fumigation methods meet the standard for an interim method, and approved interim use of the TIF tarpaulin methods when using 1, 3-D, chloropicrin or methyl bromide, as described below.

In 2013, DPR staff reviewed emission data for TIF tarpaulin applications with 1, 3-D, chloropicrin, and methyl bromide (Barry 2013a and b; Johnson 2013). No emissions data were available for TIF tarpaulin application methods for methyl isothiocyanate fumigants. The U.S. EPA had assigned a 60 percent buffer zone credit to all the TIF tarpailins included in the studies DPR reviewed. There was insufficient data to establish ratings for the TIF tarpaulin/Shallow/Bed fumigation method for 1, 3-D; all other TIF tarpaulin fumigation

methods reviewed met both the high- and low-emission rating standards. For chloropicrin, all TIF tarpaulin data were averaged and all methods assigned an application adjustment factor of seven percent; therefore, all TIF tarpaulin methods met the rating for low-emission methods. For methyl bromide none of the emission ratings have been revised due to the limited and variable TIF tarpaulin data, i.e., their emission rating remains the same as for the equivalent non-TIF tarpaulin fumigation methods. In summary, all the fumigation methods using TIF tarpaulins (shown in Table 2) met either a high- or low-emission standard for 1, 3-D, chloropicrin, and methyl bromide.

Interested parties requested DPR to evaluate new methods to determine if they met the criteria set forth in 3 CCR section 6452. In 2014, TriCal requested DPR to consider chloropicrin non-tarped, deep shank, broadcast application and the non-tarped, deep shank, broadcast, strip and GPS-targeted application as "low emissions" methods. DPR considered both and determined that the non-tarped, deep shank, broadcast, strip application fit the criteria for designation as a "low emission" method because of the reduced application rate (DPR 2014c).

Table 2 lists the field fumigation methods that can be used in the Sacramento Metro and South Coast ozone NAAs in the amended regulations. It shows the low-emission field fumigation methods that can also be used in the SE Desert, SJV, and Ventura ozone NAAs during May through October. The fumigation method codes for pesticide use reports should identify all applications that use a TIF tarpaulin, including applications where the emission rating is the same as a non-TIF tarpaulin. This allows DPR to retroactively adjust its VOC emission estimates if future studies demonstrate a decrease in emissions with TIF tarpaulins and a revised emission rating is assigned.

As stated above, interim methods expire three years after the date of approval. By not amending regulations to adopt the interim methods, using TIF tarpaulins with methyl bromide would have required growers and applicators to use polyethylene tarpaulins; therefore, further reduction in VOC emissions for each acre fumigated would not be achieved. This is contrary to DPR's goal for VOCs and U.S. EPA's goal to reduce stratospheric ozone depletion. Also, 1, 3-D and chloropicrin (and MITC-generating products) fumigation methods can currently use TIF tarpaulins, although the reduction cannot be applied to meet our SIP requirements. If these regulations had not been amended, the interim methods' allowance would have expired in 2016 (2017 for the strip applications). Using these methods with TIF tarpaulins lowers emissions, which decreases the VOC contribution due to fumigants. The designation of a new method code and emission rate for the methods allows DPR to have a more accurate inventory of VOC emissions, which it is required to maintain.

Options Considered for Reducing Pesticide VOC Emissions and Alternatives Analysis for Low-Emission Fumigation Application Methods

Since the changes to the field fumigation application methods involve using a more effective tarpaulin (i.e., TIF tarpaulin) that is only a change in technology, DPR will not provide further information about options considered and alternatives analyzed. Please refer to DPR documents (DPR 2014d and 2015) for a thorough discussion of possible options and alternatives.

Benefits and Costs of Low-Emission Field Fumigation Methods

As part of the rulemaking package, DPR worked with the Air Resources Board (ARB)

Agency-wide Economic Analysis Unit to estimate the direct cost of these low-emission field fumigation method regulations.

Several methods for chloropicrin and 1, 3-D are not allowed in the SE Desert, SJV and Ventura when using standard tarpaulins, as listed below.

Chloropicrin
Tarpaulin/Shallow/Broadcast – Nobel plow – Strip (Section 6447.3 (a)(3), method code 1104)
Tarpaulin/Shallow/Broadcast – Closing shoe and compaction roller (Section 6447.3 (a)(3), method code 1105)
Tarpaulin/Shallow/Bed (Section 6447.3 (a)(4), method code 1106)
Tarpaulin/Deep/Broadcast – Strip (Section 6447.3 (a)(5), method code 1108)

1, 3-D
Tarpaulin/Shallow/Broadcast (Section 6448.1 (d)(2), method code 1202)
Tarpaulin/Shallow/ Bed (Section 6448.1 (d)(2), method code1203)

However, these methods are allowed in these three NAAs when TIF tarpaulins are used. Review of studies has determined that when a TIF tarpaulin is used with the above methods, the emissions fall within the criteria designated as "low-emission" methods (DPR 2013 and DPR 2014a).

In addition to lowering emissions from fumigations, the use of TIF tarpaulins may have other benefits for growers. The use of the TIF tarpaulins can reduce the size of buffer zones required for chloropicrin applications, so instead of going out to the same field multiple times to do various blocks of one to ten acres to manage buffer zones, growers can do the same total area in fewer, larger-sized blocks. This saves the grower repeat costs on labor and transport and fuel surcharges, etc. but still allows for treatment of the same number of acres. In addition, use of TIF tarpaulins allows the growers to apply less pesticide (decrease the application rate) in some fields. On average, TIF tarpaulins add another $300 per acre to the cost of tarping with polyethylene. This extra cost can be nullified by reducing the application rate, saving personnel time, etc. as described previously. A polyethylene-tarped field has the same labor cost as a TIF-tarped field because the applicator needs the same number of workers and has the same costs (Stanghellini 2015, personal communication).

In addition, TIF tarpaulins are used to manage DPR's "township cap" requirements for 1, 3-D. The township cap is a similar, but separate, requirement from the VOC fumigant emission limit, and is used to control cancer risk from 1,3-D. Each township (6 x 6 square mile area) has a limit in the amount of 1, 3-D that can be used on an annual basis. The 1, 3-D amounts are "adjusted total pounds" using Application Factors that vary from 0.3x to 2.3x of pounds applied depending on fumigation method, month, and region. The Application Factors account for differences in emissions and air concentrations associated with different application methods, field conditions, and weather conditions. Most TIF tarpaulin Application Factors are approximately four times lower than non-TIF tarpaulin applications, allowing more acreage to be fumigated and still meet the township cap requirements.

Although there were no changes in use in the affected NAA's for most of methods that were previously not allowed, the use of TIF methods increased over the non-TIF methods that were

allowed (Table 3), indicating growers saw a benefit when using the TIF tarpaulin methods.

As seen in Table 3, most applications using an interim method were in the Ventura ozone NAA. The other ozone NAA areas do not have the same concerns with maintaining smaller buffer zones since they are areas that are generally more rural. The 1, 3-D township cap requirements also impact the Ventura ozone NAA more than other areas. Therefore, the economic analysis is limited to the Ventura ozone NAA. Table 4 shows the data for field fumigant applications made in Ventura County by the various methods from 2008 to 2013, the first year the interim methods were allowed.

Tarpaulin/shallow/broadcast – nobel plow (method code 1103) applications were replaced by tarpaulin/shallow/broadcast – nobel plow – with TIF tarpaulin (method code 1143) applications and about half of the drip chemigation/tarpaulin (method code 1209) were replaced with drip (chemigation)/tarpaulin – with TIF tarpaulin (method 1259). Also in the Ventura ozone NAA, the allowance of the newly adopted method tarpaulin/shallow/broadcast – with TIF tarpaulin (method code 1242) allowed growers to use a method that was previously not allowed, i.e., tarpaulin/shallow/broadcast (method code 1202).

Table 5 compares the interim method to the method most likely used in previous years. In 2013, most of the methyl bromide tarpaulin/shallow/broadcast – nobel plow (method code 1103) applications were done with TIF tarpaulins. Using this new method resulted in similar acres treated as in previous years but with a fewer number of applications, indicating that each application was made to more total acres. All applications using the 1, 3-D tarpaulin/shallow/broadcast method were made with TIF tarpaulins in 2013. The data for the chemigation (drip system)/tarpaulin (method code 1209) is not as clear since the 1,3-D applications do not require buffer zones dependent on application size and the TIF tarpaulin application factor is the same as the non-TIF tarpaulin application factor due to lack of TIF tarpaulin data. Therefore, there is less incentive to use TIF tarpaulins for 1, 3-D drip applications.

The numbers of acres, on average, that were fumigated in a single application increased with the use of the interim methods. The use of the interim method with TIF tarpaulin/shallow/broadcast (method code 1103) resulted in an average application size of 31 acres to fumigate the total 3,566 acres using a tarpaulin shallow broadcast method as compared to 14 to 22 average acres per application in previous years. The use of TIF tarpaulins with a tarpaulin/shallow/broadcast (method code 1242) increased the average acreage per application by more than twice. In 2013, when buffer zones were added to the federal labels, the use of the TIF tarpaulin interim method for drip applications increased the size of the average application to what was an average size in previous years over the non-TIF tarpaulin method in the same year.

Conclusion

DPR has implemented or is working to implement all feasible measures to reduce VOC emissions from pesticides. DPR has amended its regulations to allow the use of low-emission fumigation methods, usually consisting of applications using TIF tarpaulins. These low-emission field fumigation methods amendments help achieve the needed VOC reductions by making additional effective low-emission field fumigation methods available permanently.

As described above, DPR can ensure that the SIP goals will be consistently achieved by making the use of these additional low-emission field fumigation methods available permanently.

Documents Relied Upon

Barry, T. 2013a. Total mass loss estimates for chloropicrin totally impermeable film tarp applications. Memo to Randy Segawa, April 10, 2013. Department of Pesticide Regulation, California Environmental Protection Agency, Sacramento.

Barry, T. 2013b. Methyl bromide totally impermeable film tarp mass loss estimates. Memo to Randy Segawa, April 16, 2013. Department of Pesticide Regulation, California Environmental Protection Agency, Sacramento.

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DPR. 2014a. *Director's Decision Concerning Environmental Monitoring Branch's Request for Approval of Reduced Volatile Organic Compound Emissions Field Fumigation Method.* Director, Department of Pesticide Regulation. July 31, 2014. http://www.cdpr.ca.gov/docs/emon/vocs/vocproj/tif_strip_decision.pdf

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DPR. 2014c. Pesticide Registration and Evaluation Committee Minutes, September 19, 2014. http://cdpr.ca.gov/docs/dept/prec/2014/091914-minutes.pdf

DPR. 2014d. Reducing Volatile organic compound emissions from Pesticides: Analysis of Alternatives for nonfumigant pesticide products. October 16, 2014.

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Spurlock, F., B. Johnson and A. Tuli. 2013. Hydrus Simulation of Chloropicrin and1,3-Dichloropropene Transport and Volatilization in the Lost Hills Fumigation Trials. 2013. Memo from Frank Spurlock, Bruce Johnson, and Atac Tuli to Randy Segawa, Environmental Monitoring Branch, DPR. February 8, 2013. http://www.cdpr.ca.gov/docs/emon/pubs/ehapreps/analysis_memos/2420-segawa_final.pdf

Ventura County Crop Report. 2013. http://vcportal.ventura.org/AgComm/docs/crop-reports/2013CropReport.pdf

Table 1. Emission criteria for approving new fumigation methods

Maximum Allowed Emission Rating and Emission Rate	**Sacramento Metro, South Coast ozone NAAs**	**San Joaquin Valley, Southeast Desert, Ventura ozone NAAs**
1,3-D emission rating (%)	65	44
1,3-D emission rate (pounds/acre)	216	146
Chloropicrin emission rating (%)	64	44
Chloropicrin emission rate (pounds/acre)	256	176
Methyl bromide emission rating (%)	100	48
Methyl bromide emission rate (pounds/acre)	400	192

Table 2. Interim field fumigation methods recently adopted into regulation

Regulation Section*	Field Fumigation Method	Fumigation Method Code	Emission Rating (%)	Can also be used in Southeast Desert, San Joaquin Valley & Ventura ozone NAAs 5/1 – 10/31
6447.3.	**Methyl Bromide Fumigation Methods (with or without chloropicrin)** (low emission rating ≤ 48%; high emission ≤ 100%)	**1100 series**		
(a)(3)	TIF/Shallow/Broadcast – Nobel Plow	1143	48	X
(a)(3)	TIF/Shallow/Broadcast – Nobel Plow – Strip	1144	74	
(a)(3)	TIF/Shallow/Broadcast – Closing shoes and compaction roller	1145	100	
(a)(4)	TIF/Shallow/Bed	1146	100	
(a)(5)	TIF/Deep/Broadcast	1147	48	X
(a)(5)	TIF/Deep/Broadcast – Strip	1148	74	
(a)(6)	TIF/Drip System – Hot Gas	1149	100	
6448.1.	**1,3-Dichloropropene Fumigation Methods (with or without chloropicrin)** (low emission ≤ 44%; high emission ≤ 65%)	**1200 series**		
(d)(5)	Nontarpaulin/Deep/Strip	1210	26	X
(d)(5)	Nontarpaulin/Deep/GPS targeted	1211	26	X
(d)(2)	TIF/Shallow/Broadcast	1242	10	X
(d)(2)	TIF/Shallow/Bed	1243	65	
(d)(4)	TIF/Shallow/Bed/Three Water Treatment	1245	44	X
(d)(6)	TIF/Deep/Broadcast	1247	10	X
(d)(6)	TIF/Deep/Bed	1248	26	X
(d)(6)	TIF/Deep/Broadcast/Strip	1249	21	X
(d)(7)	TIF/Chemigation (Drip System)	1259	29	X
6447.3	**Chloropicrin + Methyl Bromide Fumigation Methods** (for all chloropicrin methods, low emission rating ≤ 44%; high	**1100 series**		
(a)(3)	TIF/Shallow/Broadcast – Nobel Plow	1143	48	x
(a)(3)	TIF/Shallow/Broadcast – Nobel Plow – Strip	1144	74	
(a)(3)	TIF/Shallow/Broadcast – Closing shoes and compaction roller	1145	100	

(a)(4)	TIF/Shallow/Bed	1146	100	
(a)(5)	TIF/Deep/Broadcast	1147	48	X
(a)(5)	TIF/Deep/Broadcast – Strip	1148	74	
(a)(6)	TIF/Drip System – Hot Gas	1149		
6448.1	**Chloropicrin + 1,3-D Fumigation Methods**	**1200 series**		
(d)(5)	Nontarpaulin/Deep/Strip	1210	26	X
(d)(5)	Nontarpaulin/Deep/GPS targeted	1211	26	X
(d)(2)	TIF/Shallow/Broadcast	1242	10	X
(d)(2)	TIF/Shallow/Bed	1243	65	
(d)(4)	TIF/Shallow/Bed/Three Water Treatment	1245	44	X
(d)(6)	TIF/Deep/Broadcast	1247	10	X
(d)(6)	TIF/Deep/Bed	1248	26	X
(d)(6)	TIF/Deep/Broadcast Strip	1249	21	X
(d)(7)	TIF/Chemigation (Drip System)	1259	29	X
6447.3	**Chloropicrn Only Fumigation Methods**	**1100 series**		
(a)(3)	TIF/Shallow/Broadcast – Novel Plow	1143	48	X
(a)(3)	TIF/Shallow/Broadcast – Novel Plow – Strip	1144	74	
(a)(3)	TIF/Shallow/Broadcast – Closing shoes and compaction roller	1145	100	
(a)(4)	TIF/Shallow/Bed	1146	100	
(a)(5)	TIF/Deep/Broadcast	1147	48	X
(a)(5)	TIF/Deep/Broadcast – Strip	1148	74	
	Metam-sodium and Metam-potassium Fumigation Methods	**1400 series**		
6450.1(e)(7)	TIF/Chemigation (Drip System)	1447	9	X

*Title 3, California Code of Regulations
Methods not highlighted were adopted as interim methods in 2013; that status will expire in 2016. Highlighted methods were adopted as interim methods in 2014; that status will expire in 2017.

Table 3. Summation of acres for each allowed application method in the three restricted ozone NAAs.

		2012				2013		
	Method	Sum of acres				Sum of acres		
	Code	SJV	SE Desert	Ventura		SJV	SE desert	Ventura
Tarpaulin/Shallow/Broadcast – Nobel Plow	1103	2,158		4,330		3,020		4
Tarpaulin/Deep/Broadcast	1107							
Tarpaulin/Shallow/Broadcast – Nobel Plow–with TIF	1143†							3,562
Tarpaulin/Shallow/Broadcast – Nobel Plow – Strip –with TIF	1144†*							
Tarpaulin/Shallow/Broadcast – Closing shoes and compaction roller–with TIF	1145†*							
Tarpaulin/Shallow/Bed –with TIF	1146†*							
Tarpaulin/Deep/Broadcast –with TIF	1147†							
Tarpaulin/Shallow/Broadcast	1202*			48				
Nontarpaulin/Shallow/Broadcast /Three Water Treatments	1204	422				358		
Tarpaulin/Shallow/Bed/Three Water Treatment	1205							
Nontarpaulin/Deep/Broadcast or Bed	1206	10,713		38		12,472	128	
Tarpaulin/Deep/Broadcast	1207	66				90		
Tarpaulin/Deep/Bed	1208			330				
Chemigation (Drip System)/Tarpaulin	1209		296	10,797		2	422	3,814
Nontarpaulin/Deep/Strip	1210†							
Nontarpaulin/Deep/GPS-targeted	1211†							
Tarpaulin/Shallow/Broadcast –with TIF	1242†							113
Tarpaulin/Shallow/Bed–with TIF	1243†							
Tarpaulin/Shallow/Bed/Three Water Treatment –with TIF	1245†							
Tarpaulin/Deep/Broadcast –with TIF	1247†					23		437
Tarpaulin/Deep/Bed–with TIF	1248†							
Tarpaulin/Deep/Broadcast-strip –with TIF	1249†							
Chemigation (Drip System)/Tarpaulin –with TIF	1259†							3808

*Allowed as chloropicrin only.

†Former interim method

Table 4. Summation of treated acres and number of applications in the Ventura ozone NAA by method code.

	2008		2009		2010		2011		2012		2013	
Method code	Acres	No. apps.	Acres	No. apps.	Acres	No. apps.	Acres	No. apps.	Acres	No. apps.	Acres	No. apps.
1103	524	36	2,162	153	2,709	187	2,397	146	4,330	194	3	2
1143†											3,562	112
1202									48	4		
1206			130	6	150	7	84	3	38	2		
1208									330	17		
1209	2,085	52	7,304	144	10,220	232	6,773	131	10,797	243	3,814	106
1242†											113	4
1247†											437	24
1259†											3,808	83
Grand Total	2,610	88	9,596	303	13,094	449	9,264	294	15,600	476	11,750	358

†Former interim method.

Table 5. Summation of acres and number of applications for related methods in the Ventura ozone NAA from 2009-2010.

	2009		**2010**		**2011**		**2012**		**2013**	
		No.		**No.**		**No.**		**No.**		**No.**
Fumigation Method	**Acres**	**Apps.**	**Acres**	**Apps.**	**Acres**	**Apps.**	**Acres**	**Apps.**	**Acres**	**Apps.**
1103	2,162	153	2,709	187	2,397	146	4,330	194	4	2
1143†									3,562	112
Total									**3566**	**114**
Average acreage/application	**14**		**15**		**16**		**22**			**31**
1202							48	4		
1242†									113	4
Average acreage/application							**12**			**28**
1209	7,304	144	10,220	232	6,773	131	10,861	243	3,814	106
1259†									3,808	83
Total									**7622**	**189**
Average acreage/application	**51**		**44**			**52**		**45**	**36** **46**	

†Former interim method.

As of November 29, 2017